WHAT IS CLAIMED IS:

1. A method for determining at least one process parameter, the method comprising:

obtaining calibration measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

determining a mathematical model by using said known values of said at least one process parameter and by employing a regression technique on said calibration measurement data, said mathematical model comprising a number of regression coefficients;

obtaining measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter; and

determining the unknown value of said at least one process parameter for said object from said obtained measurement data by employing said regression coefficients of said mathematical model.

2. Method according to claim 1, wherein said calibration measurement data and said measurement data are obtained with an optical detector.

3. Method according to claim 2, wherein said optical detector is a scatterometer.

4. Method according to any of the preceding claims, wherein the regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

5. Method according to any of the preceding claims, wherein said object is a substrate.

6. Method according to claim 5, wherein the substrate comprises one of a group

consisting of a test wafer and a product wafer.

7. Method according to claim 5 or 6, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

8. Method according to claim 7, wherein the at least one marker structure is a part of a device pattern within a chip area.

9. Method according to any of the preceding claims, wherein the at least one marker structure comprises a diffraction grating.

10. Method according to any of the preceding claims, wherein the method further comprises preprocessing the obtained calibration measurement data and the obtained measurement data before said employing said regression coefficients.

11. Method according to claim 10, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

12. Method according to any of the preceding claims wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

13. Method according to claim 12, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

14. Method according to claim 12 or 13, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure

comprises a pattern with dense lines or isolated spaces.

15. Method according to any of the claims 12-14, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

16. Method according to any of preceding claims, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

17. Method according to any of the preceding claims, wherein said calibration data and measurement data comprise spectral data.

18. Method according to any of the preceding claims, wherein said method is related to at least one of a lithographic apparatus and a track.

19. Method according to claim 18, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

20. Method according to claim 18 or 19, wherein the lithographic apparatus comprises:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

21. A semiconductor device produced with the method according to any of the

preceding claims.

22. A system for determining at least one process parameter, the system comprising:

a detector arranged to obtain calibration measurement data from a plurality of calibration marker structure sets provided on a calibration object, each of said plurality of calibration marker structure sets comprising at least one calibration marker structure, calibration marker structures of different calibration marker structure sets being created using different known values of said at least one process parameter;

a processor unit storing a mathematical model determined by using said known values of said at least one process parameter and by employing a regression technique on said calibration measurement data, said mathematical model comprising a number of regression coefficients;

said processor unit being arranged to obtain measurement data from at least one marker structure provided on an object, said at least one marker structure being made using an unknown value of said at least one process parameter; and to determine the unknown value of said at least one process parameter for said object from said obtained measurement data by employing said regression coefficients of said mathematical model.

23. System according to claim 22, wherein said detector is an optical detector.

24. System according to claim 23, wherein said optical detector is a scatterometer.

25. System according to any of the claims 22-24, wherein the regression technique used by the mathematical model is selected from a group consisting of principal component regression, non-linear principal component regression, partial least squares modeling and non-linear partial least squares modeling.

26. System according to any of the claims 22-25, wherein said object is a substrate.

27. System according to claim 26, wherein the substrate comprises one of a group consisting of a test wafer and a product wafer.

28. System according to claim 26 or 27, wherein the at least one marker structure is positioned on said substrate within one of the group consisting of a chip area and a scribe-lane.

29. System according to claim 28, wherein the at least one marker structure is a part of a device pattern within a chip area.

30. System according to any of the claims 22-29, wherein the at least one marker structure comprises a diffraction grating.

31. System according to any of the claims 22-30, wherein the processor unit is arranged to preprocess the obtained measurement data before said employing said regression coefficients.

32. System according to claim 31, wherein said preprocessing comprises performing on said data at least one of the group of mathematical operations consisting of subtraction of a mean, division by standard deviation, selection of optical parameters and weighing of optical parameters, and

wherein the optical parameters comprise at least one of the group of parameters consisting of wavelength, angle and polarization state.

33. System according to any of the claims 22-32 wherein each of said plurality of calibration marker structure sets comprises at least a first and a different second calibration marker structure.

34. System according to claim 33, wherein said first calibration marker structure comprises a number of non-patterned layers and said second calibration marker structure comprises the same non-patterned layers on top of which a pattern is provided.

35. System according to claim 33 or 34, wherein said first calibration marker structure comprises a pattern with isolated lines and said second calibration marker structure comprises a pattern with dense lines or isolated spaces.

36. System according to any of the claims 33-35, wherein the first and second calibration marker structures are in close proximity to each other, such that a distance between the first and second calibration marker structure is in the same order of magnitude as a size of the first and second calibration marker structure.

37. System according to any of claims 22-36, wherein at least one calibration structure within a calibration marker structure set and said marker structure have substantially comparable shapes.

38. System according to any of the claims 22-37, wherein said calibration data and measurement data comprise spectral data.

39. System according to any of the claims 22-38, wherein said system comprises at least one of a lithographic apparatus and a track.

40. System according to claim 39, wherein said at least one process parameter is selected from a group consisting of focus, exposure dose, overlay error, track parameters related to dose, variation of line width over reticle, variations from reticle-to-reticle, projection lens aberrations, projection lens flare, and angular distribution of light illuminating the reticle.

41. System according to claim 39 or 40, comprising:

an illumination system configured to provide a beam of radiation;

a support structure configured to support a patterning structure, the patterning structure serving to impart the beam of radiation with a pattern in its cross-section;

a substrate table configured to hold a substrate; and

a projection system configured to project the patterned beam onto a target portion of the substrate.

42. A semiconductor device produced with the system according to any of the claims 22-41.

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